Charge to the SMD Advisory Committees:
Review NASA SMD R&A Methods to Foster High-Impact and Interdisciplinary Research
July 2017

Purpose: Determine how SMD's Research and Analysis (R&A) program can foster and enable, in the best way, potentially high-impact and highly innovative endeavors, while preserving important foundational and/or more gradual research activities, and interdisciplinary research, balancing this with discipline-focused research, to the benefit of the nation and scientific community. Both content and process aspects (which are connected) will be involved.

Task: Deliberate and provide written advice on the two questions posed below, utilizing the full capabilities of the NAC Science Committee and the four new SMD division committees – Astrophysics Advisory Committee, Earth Science Advisory Committee, Heliophysics Advisory Committee and Planetary Advisory Committee. Each committee is asked to review materials, represent the views of the scientific community, and draw on member experience with both SMD and other research programs. The advice delivered should address the issues at a tactical use-focused level, rather than focusing on generalities at a strategic level. Each question should have an answer which includes options and solutions and their associated pros/cons, as well as any supporting data for a given option.

Key Questions:

1. Does the SMD R&A program have processes in place to effectively solicit, review and select high-impact/high-risk projects?
    a) What is your committee's working definition of a high-impact project? A high-risk project?
    b) Are there aspects of the solicitation, review and selection process that could be added, removed or modified that would allow SMD to more effectively elicit and support high-risk/high-impact projects or, is the current practice of soliciting by topic and evaluation for merit followed by flagging high-impact/high-risk projects for the selection official adequate?
    c) If it were to be recommended that solicitations or evaluation methods be modified for high-impact/high-risk projects, how should these be designed?
    d) Acknowledging the value of incremental progress on achieving strategic objectives, and thus recognizing that much of the research that SMD supports will be of moderate impact, how should SMD determine the correct balance between moderate impact research and high-impact/high-risk research?

2. Does the SMD R&A program have effective processes in place to solicit, review and select focused, interdisciplinary, and interdivisional projects?
    a) How should SMD determine the right balance between division-specific and interdivisional research?
    b) Once determined, does SMD have effective processes in place to achieve this balance?
    c) How should each of SMD's divisions determine the right balance between discipline-focused and interdisciplinary research?

d) Once determined, do SMD's divisions have effective processes in place to achieve this balance?
e) Is SMD missing out on important interdisciplinary and/or interdivisional work because of the way in which we solicit, review, and select projects? If so, what specific research foci are missing?
f) Are there aspects of the solicitation, review and selection process that could be added, removed, or modified that would allow SMD to more effectively elicit and support interdisciplinary and or interdivisional projects?
g) If it is recommended that solicitations or evaluation methods be modified for interdisciplinary and/or interdivisional projects, how should these be designed?
h) What role, if any, should collaborative research structures such as NIH-style "Program-Project" grants, virtual institutes (the NASA Astrobiology Institute (NAI) and Solar System Exploration Research Virtual Institute (SSERVI)) and research coordination networks (the Nexus of Exoplanetary System Science (NExSS)) play?

Product to Deliver: Each SMD committee is requested to utilize its next two public meetings to receive and review information, deliberate and finalize written answers to the questions above, which could include recommendations or findings, plus any supporting data. Presentation format is the preferred medium for initial communication of the answer, followed up by a letter. Each SMD division committee is requested to provide a presentation to the Division Director, and the chair of each committee is requested to make a presentation at the Science Committee meeting. The Science Committee is requested to provide a summary and overview presentation to the SMD AA.

Materials to be Provided by NASA SMD (Attachment 1):

1) R&A program solicitations
2) Proposal evaluation criteria
3) Working definitions
4) SMD R&A program statistics (e.g. proposal selection rates, 2008-2015)
5) SMD policy documents
6) *An Enabling Foundation for NASA's Earth and Space Science Missions* (2010). A report by the Space Studies Board of the National Academies.
7) *Review of the Restructured Research and Analysis Programs of NASA's Planetary Science Division* (2017). A report by the Space Studies Board of the National Academies.

Other available and relevant material, as requested (e.g., titles/abstracts of selected proposals, division-specific information on how high-impact/high-risk and other proposals are handled)

Timeframe: July-November, 2017 (5 months) – report back at Fall advisory committee meetings

Initial Feedback from Science Committee: Initial discussions were held at the April, 2017 NAC Science Committee (SC) meeting, at the suggestion of the SMD AA, on the merits of reviewing the impact of SMD R&A. In particular, one key interest is whether the SMD R&A program is able to support revolutionary breakthroughs of high-impact, highly innovative research endeavors (which may also be high-risk). Of critical importance is the need to assess portfolio balance - whether there is an appropriate balance of high-impact/high-risk research and incremental research. Also of

interest is whether SMD R&A has the right balance of interdisciplinary versus discipline-focused work.

The SC conveyed a sense that the scientific community may perceive the R&A process to be inherently conservative and incremental. Risk-adverse choices are made by proposers (choosing safer lines of inquiry or trusted methods), reviewers (who may not be familiar with new ideas and thus not support those) and selections made by SMD officers (to safeguard success rates). The community may in consequence fail to grow new ideas, thus furthering this cycle.

A variety of tools and mechanisms already exist in the R&A program that could support high-impact endeavors. The SC underscored that multi-year awards allow long-term vision, and SMD and the SC noted generally that awards of at least 3 years work well. Also, though small-scale awards support many researchers, there may be a need for a quota for important, large-scale projects that require more investment.

Internal Data Collection: The SMD R&A program will initiate collection of at least one year of data (in ROSES 17) to support the ongoing review. Every reviewer and each program official will be asked to assess if each proposal is potentially 1) low- to high-impact, and 2) low- to high-risk. A set of working definitions for level of impact and risk will be used so these assessments can be consistent. A value for each proposal will be calculated and plotted. Especially of interest will be the number of proposals that land in the high-impact/high-risk quadrant; and what portion of those were funded. This also may be assessed by division, program or other parameters. If this assignment of values continues in future years, it is possible that policy changes could be tracked to see any resulting changes in the data, using ROSES 17 as the baseline year. In the future, SMD may ask the Committees' their view of the data results.